Some Assembly Required:

Building a Digital Government
for the 21st Century

Center for Technology in Government
University at Albany / SUNY

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Report of a Multidisciplinary Workshop Held in October 1998

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Executive summary

Government remains essential in the Information Age society. Although there is debate over structure and operation, government's objectives are indisputable: maintaining collective security, administering justice, providing the institutional infrastructure of the economy, ensuring that vital social capital is enhanced through improvements in health and education and through strong families and communities. In its role as a service provider, government needs to be fully capable of delivering high quality, effective, affordable services. However, in cases where government itself is not the best delivery vehicle, it must engage or allow others in the voluntary and profit-making sectors to carry out this role. Information technology, already an essential part of government operations, will continue to be vitally important to administration, decision making, and direct service delivery. It will also be critical in the evolving relationships between government and other kinds of organizations, and between government and citizens.

Today, government is being transformed along several dimensions. Where it was organized to act independently or according to rigid rules, it is now involved in complex patterns of interdependence. Traditional methods of public management based on hierarchical notions of "command and control" are being replaced by approaches that depend on collaboration, negotiation, and incentives among partners. The boundaries between government and business that served as clear lines of separation are now blurring as public-private partnerships emerge to address increasingly complex problems and goals.

Citizens are coming to expect vastly different performance from government. They are little concerned with which level or unit or organization delivers a service, but are increasingly concerned that those services be sensible, cost-effective, convenient, and of high quality.

Government has been at the forefront of information technology research and application for decades. We often take for granted that many traditional functions of government, such as the Social Security system and national defense, would not operate at all without information technology. However, today's technical tools, including digital communications and advanced networking, are beginning to offer transformational value to many more functional areas. We can already see their potential in relatively rare government applications that engage citizens directly. The Internal Revenue Service e-file and Telefile programs allow taxpayers to file their returns electronically using technologies as simple as their telephones. The Santa Monica Public Electronic Network (PEN) provides myriad information services to that Southern California community and serves as a virtual host for public discussion of important civic issues. Advanced computing and communications technology make programs like these technically feasible, but alone they are insufficient for achieving the kinds of services that the public demands and deserves. Leadership, management strategies, organizational structures, cross-boundary relationships, financing mechanisms, information policies, and public participation and acceptance are

all equally crucial elements of effective 21st Century government services. This extraordinarily complex combination of technical, organizational, economic, human, and political factors explains why applications like e-file and PEN are not at all common. Such programs present huge challenges along all of these dimensions, and because they are governmental, public scrutiny, the limitations of public funding, and the necessity of providing for universal access present enormous risks of failure.

In 1997, the National Science Foundation launched the Digital Government Program to support research projects that will help move American government toward the promise of transformed public services. The program fosters broad connection between government information services providers and research communities, and seeks innovative research to improve agency, interagency, and intergovernmental operations, as well as interactions between citizens and government.

Clearly, no single domain of knowledge will be sufficient to the challenge. Computer and information science, the social and behavioral sciences, and the full range of public policy domains and management disciplines need to be actively engaged. However, effective partnerships among disciplines and between researchers and practitioners face formidable barriers of their own. Different value systems, vocabularies and conceptual frameworks, and lack of awareness and experience of one another all mitigate against the kind of multidisciplinary collaboration that is needed.

In October 1998, a workshop sponsored by the Digital Government Program was convened by the Center for Technology in Government of the University at Albany/SUNY to address these challenges. The workshop focused particularly on the environment in which government information services are developed. It recognized that government programs and service delivery mechanisms are developed in a complex multi-layered Federal-state-local system in which many organizations play significant and different roles. It also emphasized that development efforts must deal with interactions among the political, organizational, technological, economic, and human factors that shape the implementation environment.

Government needs for the 21st century

By paying special attention to the needs of government program managers, workshop presentations and discussions were designed to lead to research ideas that have the potential to be of pragmatic use in government. Eight specific needs emerged from the discussion.

➢ *Interoperable systems that are trusted and secure.* Current system development methodologies cannot deal well with the scope and diversity of users, customers, and stakeholders that are involved in large government information systems. Research is needed to understand the potential for and the limits of system integration and scalability in technological, organizational, and political terms.

➢ *Methods and measures of citizen participation in democratic processes.* Internet technologies can facilitate a more personal involvement in the institutions and processes of government. Easy public access to information, electronic voting, instant public opinion polls, and other possibilities raise important questions about the nature of citizenship, the role of political leadership, and limits of change in democratic institutions.

➢ *Models of electronic public service transactions and delivery systems.* With the proliferation of the Internet among government agencies and citizens, it is possible to offer new services, integrated services, and self-service in ways and places never before possible. New methods of authentication, record-keeping, security, and access are all needed, as well as new methods of measuring costs and benefits.

➢ *New models for public-private partnerships and other networked organizational forms.* Given the diversity of players involved in delivering government services, developing effective IT systems often requires new coalitions of partners at all levels of government, and between

government and the private and nonprofit sectors. The complexity of the resulting organizational and technological relationships is daunting. Considerable legal, economic, ethical, political, and technological questions attend this evolution to new organizational arrangements.

➤ *Intuitive decision support tools for public officials.* Technologies and data standards that encourage information search, selection, analysis, and sharing can strongly influence the nature and effectiveness of decision making by elected officials, senior executives, and program managers alike. The use of new tools by decision makers may also have implications for public participation and open government.

➤ *Archiving and electronic records management.* More and more information now resides in electronic rather than physical files, generating new issues around record definition and content, version control, public access, ongoing preservation, and the ability of government to maintain history and accountability.

➤ *Better methods of IT management.* Government IT managers need ways to design and maintain more efficient, flexible, and affordable systems. Design processes, project and contract management, leadership models, and strategies for dealing with a shortage of IT professionals are all critical areas for applied research.

➤ *Matching research resources to government needs.* Applied research is usually not rewarded by academic value systems. As a consequence, researchers often pursue theoretical research instead of field work. Practitioners generally cannot or will not wait for the results of traditional research to influence their decisions, therefore, they seldom make use of research results. The best forms of research on Digital Government must overcome these obstacles and lead to readily useable knowledge.

Applied research challenges and opportunities

While the needs outlined above present more than ample opportunities for applied research, traditional research models and a historical lack of connection between research and practice present serious obstacles to success.

First, although academic research can have a significant influence on government practices, the government and research communities have very different value systems that need to be taken into account. Government is risk-averse by design, and research is quite the opposite. Government managers often need quick answers, while researchers tend to take a longer-term view. These differences need to be taken into account through the development of new models for informing and integrating practice and research.

Like government, research has its own disciplinary specialties that deepen and expand knowledge within each field. To meet the needs identified above, researchers not only must advance knowledge in individual fields, but must also find synergy across them. In particular, social and information scientists need to work together.

The intricate interdependencies of government programs require a holistic line of research that accounts for the interactions among levels of government and between the public and private sectors. Access to venues for this kind of research will require trusting long-term relationships between researchers and government managers, as well as substantial multi-year funding.

Finally, policy guidelines, organizational forms, and technology tools constantly interact with one another, generating many questions and conflicts about what is technically possible, organizationally feasible, and socially desirable. Research that focuses on the intersection of these domains is inherently multidisciplinary, complex, and difficult to design and manage, but essential to achieving the goals of Digital Government.

Digital Government Program recommendations

The complexities of the public sector environment, pressing practitioner needs, critical research challenges, and 35 specific project ideas (see p. 18) emerged from the workshop discussions. Together, these led to six recommendations to the National Science Foundation for furthering the goals of the Digital Government Program:

1. *Support research at the Federal, state, and local levels, as well as investigations into intergovernmental and public-private interaction.* The Digital Government Program should emphasize the multi-faceted nature of American government and encourage projects that look at every level of government, at multi-level functions, and at programs that link the public, private, and nonprofit sectors.

2. *Attend to issues of "governance" as well as "government" in the digital age.* Information technology can play a significant role in transforming not only government services and administration, but also the working of democratic institutions. Projects that focus on the nature and effects of "digital governance," the roles and rights of citizens, and the functioning of civil society should be included in the Digital Government research program.

3. *Encourage both social science and technology research, multidisciplinary projects, and research designs and methods that address service integration and environmental complexity.* In order to be successful, the research program will need to address the interplay among technical, management, policy, and organizational factors influencing the information systems that support government operations. With this diverse set of research questions and objectives, the program should encourage research in both social and information sciences and welcome a variety of research methods, particularly ones that directly involve system users and beneficiaries.

4. *Seek innovative funding models that build a larger resource base for Digital Government initiatives.* At present, the NSF funds allocated to the Digital Government Program are quite modest and are insufficient to support sustained research into the complex questions posed at the workshop. NSF should consider innovative funding models to increase the amount of resources available to support the program by finding co-sponsors and leveraging complementary investments already being made by other organizations.

5. *Link research and practice in an ongoing exchange of knowledge, needs, and experiences.* Given the wide communications gap between the academic and government practitioner communities, and the significant opportunity for improved practices through collaboration, new methods are needed for disseminating research results to practitioners and for infusing research with the problems of practice. NSF should encourage the development of organizational structures, information sharing mechanisms, and funding methods to bridge the gap between these two cultures.

6. *Create a practitioner advisory group for the program and include practitioners in the review panels.* If the Digital Government Program is to succeed in integrating research and practice, practitioners must have a major role in setting priorities and selecting projects to be funded. An advisory group made up of practitioners from all three levels of government would assist in program design, in attracting government funding and research partners, and in disseminating results. Practitioners must also participate in reviewing proposals that seek to study their areas of expertise. This will also help insure the relevance of projects, access to venues for field research, and an audience for the research results.

1. Background - the dimensions of American government

Federal · State · Local · Public · Private · Nonprofit
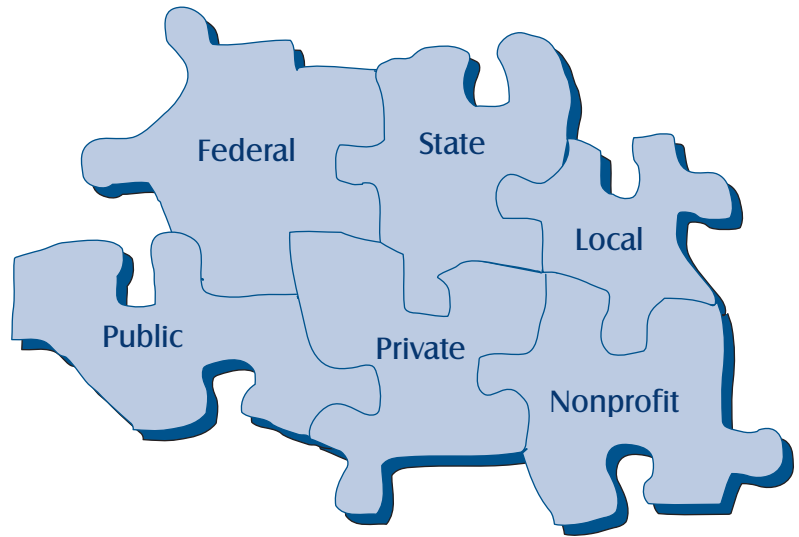
American government comprises a variety of actors playing multiple roles, a complex and variable system of federalism, and an increasingly interconnected array of public and private organizations addressing essential societal goals.

What constitutes "government?"

Government is the means by which society pursues essential objectives: maintaining collective security, administering justice, providing the institutional infrastructure of the economy, ensuring that vital social capital is enhanced through improvements in health and education and through strong families and communities. When people talk about "the government," they often mean elected officials in Washington or the state capital. They might also mean the array of government agencies that watch over the environment, collect taxes, build roads, fight crime, or conduct a host of other activities. Government can also mean the local tax assessor, the town clerk, city hall, or a tribal council. Government is actually a dynamic mixture of these goals, structures, and functions.

By any measure, American government is big and pervasive. A variety of domestic Federal functions have broad effect throughout the United States: social insurance programs like Social Security and Veterans Benefits; a national tax code; the postal service; land, wildlife, and other resource management programs; environmental quality and remediation projects; the national park system; the interstate highway system. In the mid-1990s, these and other non-defense programs and agencies employed about 2.1 million people and spent about $1.6 trillion.

State and local governments represent an even larger force. Of the 19.5 million people employed in civilian government jobs in 1995, 85 percent were employed by states (4.7 million) and localities (11.9 million, including about 5 million public school employees). In most functional areas, including public health, welfare, and safety, state and local employment exceeds Federal numbers by wide margins. Total expenditures of state and local funds for these programs was approximately $1.3 trillion in 1994. Of the $1.6 trillion in Federal outlays noted above, $218 billion or about 17 percent was in the form of intergovernmental transfers rather than spending on direct Federal functions.

The sheer number of units of government is, of course, concentrated at the local level. In 1992, there were nearly 39,000 general-purpose units of local government in the United States (about 3,000 counties, 19,000 cities, and 16,000 towns), plus more than 14,000 school districts and more than 31,000 special districts handling public water works, sewer systems, fire protection, and other special local functions.

These patterns of employment, spending, and responsibility mean that most people and organizations interact with government at the state and local levels.

Many government programs and functions operate at more than one jurisdictional level, with Federal, state, and local agencies playing different roles in a single program. Public education, for example, is governed by local boards of education, who make district-level policy and carry out statewide curricula requirements. State education departments set those uniform requirements, certify teachers, and distribute state aid to local school districts. In most states, elementary and secondary education is funded through a complicated mixture of mostly state and local funding, with small amounts of Federal aid available for targeted programs, such as Head Start and school lunches.

The interconnectedness of the public sector can encourage the spread of innovation

While elementary and secondary education have long been under mostly local and state control, other multi-level public programs have been designed and controlled with a much more forceful Federal presence. In recent years, design and control responsibilities for some of these programs, public assistance being the most notable, have been "devolved" to the states and often from there to local communities. At the same time that decision-making has moved to the state and local levels, however, Federal oversight has been expanded and tied to increasingly detailed flows of information about specific activities and performance. For example, the welfare reform law of 1996 (PL 104-193) gave states broad authority to redesign their cash assistance programs and to create strong welfare-to-work programs in their place. This grand devolution of discretion, however, has been accompanied by requirements to track and report nearly 200 separate data elements to the Federal government. Many of these require entirely new information systems that connect states to localities, localities to one another, and states to their counterparts around the country.

This richly interconnected environment complicates many aspects of government operations, but it also provides a setting in which many actors are experimenting with new tools and new ways of working. As a result, the public sector seems to provide a more supportive environment for the spread of innovation. The fact that electronic benefits transfer (EBT) is now the preferred method of benefits distribution across all Federal programs is testament to this fact. EBT began more than ten years ago as an experiment in Ramsey County, Minnesota. It was developed by the county human services agency in response to a local crisis in which no bank would cash welfare checks without a user fee. Cited by the Ford Foundation Innovations in American Government Program, EBT spread among state welfare agencies, and then to other kinds of programs. In 1994, a task force created by the National Performance Review called for a single electronic delivery method for all Federal benefits.

Who cares about the way government works?

Consider the possibilities for a Digital Government from the point of view of the people and organizations who interact with government services, rules, or information: private citizens, businesses, nonprofit organizations, and government agencies and employees themselves. Often, reports and recommendations for improving government urge that public agencies pay more attention to their "customers," or more actively engage their "stakeholders," or focus on "the citizen." These terms usually serve to focus attention on the "person in the street." While this is undeniably important, they also tend to downplay or ignore the roles and importance of the others. It therefore seems useful to outline the full range of actors concerned with the way government works.

Customers are the direct consumers of specific services. Retirees who receive Social Security benefits are customers; so are the families who vacation in state parks and the parents who bring their children to public health clinics.

Stakeholders are specific individuals, organizations, or groups that have an interest in the existence, design, cost, or outcome of a government action or program. Advocacy organizations, other units of government, and those subject to government oversight or regulation are all stakeholders in the programs that engage them. Employers, for example, care about proposed changes in minimum wage laws, and health care advocates are stakeholders in the development of managed care regulations.

Citizens are individuals who have defined rights and responsibilities in democratic processes and institutions, such as the right to vote or the right of free expression. When your neighbor enters the voting booth or rises to speak at a town meeting, she is not a consumer of government services, but an active participant in the democratic process.

Government agencies and public officials can be cast in the customer and stakeholder roles just as individuals or businesses can. A county may be the customer of the state health department and rely on it to provide a full range of public health services that the county might otherwise need to perform. States are stakeholders in many Federal programs, such as the Interstate Highway system, ready to debate and influence the laws and policies that define them.

Most interaction with government takes place at the state and local levels

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Often, the same person or organization plays several of these roles. A physician is licensed by a state board of medical examiners (making him a regulated entity), benefits from the extensive research resources of the National Library of Medicine (of which he is a customer), is active in committees of the State Medical Society which try to influence health care policy (a stakeholder), and personally urges his local school board to consider a tougher attendance policy (a citizen exercising his right to free speech and public participation).

Given all these roles and relationships, the form and features of "Digital Government" can potentially influence every kind of government service, regulatory program, decision-making process, and institution of governance.

Government services are a fabric of public and private threads

In an increasing number of situations, responsibility for public functions is divided between government agencies and one or more non-governmental organizations. A common administrative example is the outsourcing of information technology functions to private corporations. Both businesses and government agencies have tried to cut their costs and sharpen their focus on their core missions by hiring outside contractors to perform ancillary functions for them. Computer centers, printing and distribution operations, and travel services are all areas where government agencies have taken advantage of private sector expertise to streamline their operations.

A more long-standing and common example is found in many human service programs where government agencies define, regulate, and fund programs that are actually operated by nonprofit (and, increasingly, by profit making) service providers. Sometimes these same programs are also offered by government agencies directly. Shelters for homeless people are a common example at the local level. State and local governments define and regulate programs that are operated by many different nonprofit agencies such as the Salvation Army, church groups, and specially organized not-for-profit corporations. Day care programs are usually operated by nonprofit organizations or private individuals after being licensed by state agencies. Often the government agencies provide training, conduct inspections, and set rates of payment or regulate the fees that providers can charge to their clients. Local trash collection, probably the oldest example of this phenomenon, is now privatized in most communities. Private sector operation of prisons and other correctional services represents one of the newest, and more controversial, examples of this trend to mix public and private activities in a single program operation.

Other major public services are a more loosely connected, but equally complex, combination of public and private operations. Safe public air travel, for example, relies on effective interaction among FAA regulation and air traffic control, private and publicly owned airports, and commercial airlines operating as private concerns, regulated public carriers, and charters.

Public policies shape information content, flow, and infrastructure

Public information policies have a defining influence on the use of information and technology in both government and society. Some policies affect societal values such as intellectual property rights, rights of free expression, personal privacy, and access to information and to the infrastructure that delivers it. Other policies set forth the principles of information and technology use and management within government.

Policies related to the free flow of information in society were reflected in the Telecommunications Act of 1996, designed in part to foster a National Information Infrastructure (NII) as a necessary condition for universal access and continued economic growth. Intellectual property rights were updated by the passage of the Electronic Intellectual Property Act of 1998. The NII has its problems, however. A 1995 Harris & Associates public opinion poll showed a majority of people (51 percent) were very concerned about threats to their personal privacy — a figure that has increased every year since 1977. The Internet Alliance recently reported that state legislatures considered more than 700 bills related to the Internet last year, on topics such as protecting children, controlling unwanted commercial e-mail, and protecting consumer privacy online. This year, they expect the number of bills to double. These growing concerns over the effects of the Internet on personal privacy, free expression, and electronic commerce have led to Federal and state statutes and a series of court cases, all concerned with the challenges that new technologies present for personal, political, and economic values.

Polices about access to government information have also been evolving. The U.S. Federal government is the largest producer of information and publications, worldwide, a distinction unlikely to change given the current emphasis being placed on extending its reach through use of the Internet and World Wide Web. The creation, analysis, dissemination, storage, and disposal of Federal government information is guided by a plethora of policy guides, including the Freedom of Information Law (FOIL), the GPO Electronic Information Access Enhancement Act, and the Electronic Records Management rules of the National Archives and Records Administration (see Table 1), all designed to manage these information resources while insuring their accessibility and availability to the American public. These laws and guidelines have paved the way for the current information-aware legislative environment.

Public information policies address both societal values and practical goals

Federal and state information policies increasingly address the acquisition, management, and use of information technologies. This fast-paced major reorientation to government's use of information and information technologies is attested to by a spate of Federal and state policies enacted to better manage information resources and better capture the results from their use.

The Clinton administration recognized the value of information and information technologies in reports and recommendations, such as those from *The National Performance Review,* making clear the high status of information on the national agenda. The Government Performance and Results Act (GPRA) is designed to improve the confidence of the American people in the activities of the Federal government by holding Federal agencies accountable for meeting performance objectives and program missions. GPRA mandates long-range strategic planning, annual performance planning, and performance-based

Table 1. Federal Laws and Policies Governing Information Resources

Clinger-Cohen Act of 1996 (PL 104-106)

Electronic Freedom of Information Act of 1996 (HR 3802)

Electronic Intellectual Property Act of 1998

Executive Order No. 12864, President's Advisory Council on the National Information Infrastructure

Executive Order No. 13011, "Federal Information Technology"

Freedom of Information Act of 1966 (5 USC 552)

Government Performance & Results Act of 1993 (PL 103-62)

GPO Electronic Information Access Enhancement Act of 1993 (PL 103-40)

Improvement of Information Access Act of 1991

OMB Circular A-130

Paperwork Reduction Act of 1980

Paperwork Reduction Act of 1995 as amended (PL 104-13)

Privacy Act of 1974 (5 USC 522a)

"Raines Rules" October 25, 1996 OMB Memorandum

Telecommunications Act of 1996 (PL 104-104)

budgeting. Agency information technology plans must be aligned with the agency program goals, and must indicate specifically how information technology will contribute to mission attainment. The Clinger-Cohen Act redirects Federal agencies' attention from IT acquisition management to IT investment management. It also creates a chief information officer position in the agencies, reporting directly to the agency head, whose primary responsibilities are information management and development of an information architecture. GPRA, Clinger-Cohen, and a variety of other Federal statutes and rules clearly elevate IT to a top level function in Federal agencies. What this means and how it will be accomplished in the long run remain to be seen.

States have developed information policies that often mirror, but sometimes differ from, Federal principles. Most states have adopted Freedom of Information Laws, for example, but some have outlined the conditions under which fees may be charged beyond the marginal cost of reproduction — a departure from a key tenet of the Federal policy. Minnesota, Florida, and Kentucky have long histories of attention to data content and public access issues. Most state policies, however, focus on the management of information resources and technology. Florida's CIO Council, for example, has recently issued policies that focus on government data as a statewide asset, and that treat security issues under the rubric of risk management. California has also paid close attention to policies and practical guidelines that evaluate risk in IT development. Massachusetts presents a portfolio of IT initiatives to its legislature each year, focusing on total costs and benefits rather than one idea at a time. Similarly, New York's policies rest on principles that favor interagency cooperation and statewide benefits over the needs of individual agencies. Texas is a leader in policies and activities related to electronic commerce.

Local governments are also information policy makers, with authority over cable TV franchises, as well as responsibility for the use of information and technology to support local government functions. New York City, for example, has recently issued an executive order creating a Technology Steering Committee with wide ranging responsibility for coordination and oversight of technology strategies and investments. Philadelphia is credited with using IT investment strategies to help accomplish a major economic turnaround.

Viewed in its totality, American government is an organism of structural and functional complexity in which Federal, state, and local levels all play critical, intertwined roles. In addition, government and the private and nonprofit sectors often share responsibility for public programs and resources. Moreover, public institutions and services, and the policies which guide them, are evolving to account for these changing relationships and for the effects of rapidly advancing technology. Information technology, already deeply embedded in most government operations, will continue to be vitally important to administration, decision making, and direct service delivery. It will also be a critical factor in the evolving relationships between government and other kinds of organizations, and between government and citizens. All of these elements, and their intricate dynamics, represent rich areas for new research.

2. The new web - technology, policies, people, and organizations
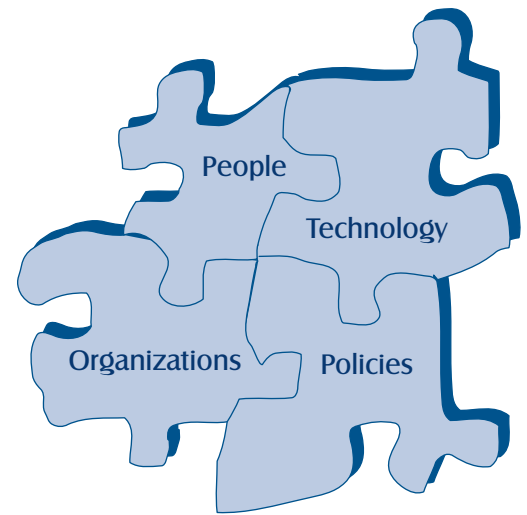
People

Technology

Organizations

Policies

A dvanced applications of information technology in government are well-integrated combinations of policy goals, organizational processes, information content, and technology tools that work together to achieve public goals.

One of the specific goals of the Digital Government Program is to speed innovation, development, deployment, and application of advanced technologies into useable systems. Two existing examples help illustrate how this goal might be achieved.

At nearly $100 billion a year, Medicaid may be the highest cost domestic program offered by American government. Because of its size and cost, even small amounts of error or fraud cost taxpayers millions of dollars. In Texas, a new fraud detection program is fueled by one of today's most advanced applications of information technology — neural networks that identify patterns in data that suggest areas ripe for investigation and corrective action.

Safe streets, schools, and downtowns are prerequisites for economic growth and civic engagement. Public safety is therefore often the number one concern of local governments. To help fight crime, the New York City Police Department has infused local policing with precinct-by-precinct incidence and performance information, backed up by management processes and political commitment to use that information to direct police operations throughout the City. This consistent and sophisticated marriage of information, management, and policy direction is an equally advanced use of information technology — even though the technology itself has been commercially available for years.

The Texas system uses a "leading edge technology" to support an important programmatic goal, where the New York City example incorporates commonly-available technology into a "leading edge application" that is part of a broad programmatic strategy. What, then, is an "advanced application of information technology" in government? The results of the October 1998 Workshop suggest this definition: "*Advanced applications of information technology in government are well-integrated combinations of policy goals, organizational processes, information content, and technology tools that work together to achieve public goals.*"

Given that definition, what might 21st Century Digital Government look like? Fully developed, these now-unusual situations will be commonplace:

➢ A couple expecting twins and planning to renovate their home will use their television to submit and receive all the necessary plans and permits electronically via e-mail and the Internet. There will be no need to take time off from work or to devote precious Saturday mornings or family evenings to visit their town hall, planning board, building inspector, or zoning commission.

➢ An enterprising young man who wants to open a lakeside restaurant catering to boaters will use his home PC to apply for all the business permits he needs in one sitting through one World Wide Web site — despite the fact that his business is of

concern to the state and local health departments, Federal and state tax agencies, the state environmental protection commission, the labor department, and local zoning and economic development officials.

➤ A government disaster response coordinator will use wireless communications, multi-media analytical tools, and dynamic and static geographic data from Federal, state, local, and private sources to direct a massive recovery effort following a devastating ice storm. These integrated and constantly updated information sources will help restore bridges, roads, power grids, telecommunications services, water supplies, health care facilities, homes, farms, schools, and businesses.

➤ A state legislator considering a proposed tax package will apply easy-to-use advanced data analysis tools to assess the impact of the proposed legislation on citizens in her district, post this analysis on the Internet for the voters to read, and poll voters for their opinions. The legislator will hold a virtual "town meeting" through the Internet where she can present her analysis of the bill and gather feedback from her constituents.

Technology and digital government

The technologies involved in these transformations — networking and the Internet, decision support systems, electronic commerce, knowledge discovery tools, geographic information systems — are not necessarily the most advanced tools available. Public sector innovations tend to result more often from the infusion of well-developed technologies into the complexities of governmental programs and processes, in an environment with many stakeholders and competing values. In this section, we highlight some of the technologies that support this transformation. We also point out special issues that affect how government takes advantage of these technologies and identify areas where additional research is needed.

Networking and the Internet

In a relatively brief span of time, the Internet has led to significant changes in how public agencies disseminate information, how government staff interact with each other and with people outside government, and how government delivers services. The most obvious examples are government WWW sites. Agencies ranging in size from large Federal departments to small towns and villages have public Web sites, designed to meet their high-priority objectives — economic development, tourism, information about government services, purchasing, statistical data, or selected service transactions. An electronic mail address on the Web site makes elected officials accessible to their constituents and allows citizens to communicate directly with public employees.

In addition to person-to-person communication, the Internet is increasingly being used to exchange data between organizations. This includes record-oriented transactions, real-time querying of remote databases, as well as larger exchanges of complete GIS data sets or other databases integrated into data warehouses. Processing of workers compensation claims, for example, may involve real-time transactions against databases from a half-dozen organizations to verify eligibility.

The use of the Internet for public purposes inevitably raises the issue of equal access. In 1997, about 17 percent of private households in the U.S. had direct access to the Internet and these were concentrated in middle- and upper-income areas of cities and suburbs. Often those most in need of government services are those least likely to have access to the Web. Rural areas, with less likelihood of having high-performance technologies such as ISDN or cable modems, are at a disadvantage, as are lower-income households, grass-roots community organizations, and small businesses that often lack direct access. While Internet access through schools, libraries, or other public places is increasingly available, people without direct access remain at a disadvantage compared to the connected minority. Given this uneven distribution of access to the Web, traditional service delivery through telephone, mail, and face-to-face interactions will be needed for many years to come.

Collaboration tools

Communication tools support and nurture linkages and relationships that were not possible through more formal means of communication. More and more often, we expect people, including government staff, to have and use electronic mail. Discussion listservs and shared Web sites routinely connect distributed organizations and virtual communities, fostering increased discussion and cooperation among those who share a common interest. Easy public availability of such information as government contracts or grant programs fosters greater equity and efficiency of government purchasing and the distribution of public resources.

Videoconferencing is another technology that is making its way into standard government practice. For example, video technology is used today to interview crime victims who would otherwise have to travel long distances to a police precinct or court house. At present, however, the use of videoconferencing typically consists of dedicated facilities linked by telephone lines. As a result, the technology tends to be used in a localized and specialized fashion. As Internet videoconferencing technology matures, it is likely that many more such interactions will take place.

Advanced IT applications in government must integrate policies, processes, information, and technology

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These relatively ubiquitous capabilities are being augmented by more advanced collaborative tools in such areas as distance learning, just-in-time training, and anytime-anyplace meetingware. Use of the Internet and video conferencing techniques to deliver entire curricula from remote sites extend higher education and lifelong learning to many who would otherwise not be able to attend classes. Distance courses in specialized topics enable elementary and high school students to pursue studies unavailable to them in their home districts. Thanks to networked collaboration, these students can even conduct joint science experiments with their counterparts around the world. Although the pedagogic effectiveness of alternate modes of study and instruction are still being evaluated, it is clear that network-supported learning will play an increasingly important role in the future of American education.

The Internet also has the capability to extend expertise across physical distances. In medicine, for example, a specialist can expand his sphere of effectiveness, without traveling, by remotely reviewing diagnostic tests. This technological capability has not yet been extensively used in the U.S., though, in part because it requires changes in insurance rules as well as changes in the culture and traditions of medical practice.

Knowledge management and analysis

Data visualization, knowledge extraction, data integration, and digital library technologies have put the power of distributed information to useful social, scientific, and individual purposes. Data mining tools aid in identifying fraud and abuse in government programs. Data warehouses gather and integrate data from disparate sources, and data management and knowledge discovery tools are used to conduct planning and program evaluation in areas ranging from capital construction, to economic forecasting, to the performance of schools. Technologies such as data intensive computing environments facilitate the use of information from disparate heterogeneous databases. Digital library technologies are emerging to help users find and use information and records regardless of physical format or location.

Today use of these advanced analysis tools varies considerably across agencies and levels of government, and it is too early to tell which applications will be most useful and adaptable. Applications of these technologies are limited today by at least three important considerations: poor or variable data quality, the willingness and ability of organizations to share information across their boundaries, and, when applications involve information about people, threats to personal privacy.

Government, particularly at the Federal level, is already an active partner in the research needed to develop and employ this next generation of data management applications through such projects as the Next Generation Internet, the Partnership for Advanced Computational Infrastructure, and the Digital Libraries initiative.

Security mechanisms

The exchange of information through a network is not a new phenomenon in government. In the past, telecommunication was accomplished using dedicated point-to-point connections between pairs of agencies, or through secure value-added networks. TCP/IP networks are now replacing these facilities. The use of these Internet protocols facilitates communication between partners because only a single connection need be maintained to communicate with all partners on the network. However, the communication channel must retain properties that duplicate those found in earlier modes of communication: secure and private communication, authentication of messengers, integrity of messages, and stability of the network.

One way to achieve this goal is to create a separate network, closed to all but trusted communicators. This model works for certain types of transactions, but since government agencies often work closely with many other organizations, a more affordable and open solution is needed. At present, there are no commonly implemented models of security architecture that provide a trusted basis for electronic interactions. The array of issues, and the limited choices of technologies and strategies has led to very slow progress in deploying these architectures. In such an environment, it is not surprising that issues of security dominate much of the discussion in government about networking.

Document management and preservation

An increasing number of important government records are now stored exclusively in electronic media. Many of these records contain multi-media formats, and they are often associated with automated workflow and electronic document repositories. Depending on the circumstances, informal information such as electronic mail messages may be part of an official government record. Few guidelines exist for effectively managing digital public records, yet their numbers grow dramatically every month.

Preservation of electronic records is a particular challenge, as the media, software, and hardware used to create records and maintain them for active use are replaced with new generations every few years. Ironically, while the records of the 17th and 18th centuries remain readable today, our own generation of records is rapidly disappearing due to technological advances. At the same time, government archives are increasingly trying to accommodate the digitization of historical records in order to make these holdings more widely accessible to more users.

Finally, with the increasing availability of information in electronic form, it is becoming easier to use information for purposes beyond the original reason for its collection. Yet most government records systems are created without regard to the needs or preferences of secondary users, whether they are in different units of the same agency, in other organizations, or are future users whose interests come into play long after the records have served their primary purpose. More extensive research into archives and records management theory and practice are needed to resolve these issues.

User interfaces

The standard user interface and the World Wide Web browser, itself a product of NSF-sponsored research, have done much to extend useful computing to every area of our society. The standard interface, commonly based on Microsoft Windows, flattens the learning curve needed for each new application. The Web browser's ease of use and widespread public acceptance have led many agencies to use this technology in direct public contact.

One attractive feature of the WWW is its ability to integrate information and services from separate organizations into a single user presentation. This technique has been used to develop Web sites that serve as a portal to all that a government unit has to offer. Today, most of these sites are limited to a single

level of government, and do not represent true integration of services. Instead, they typically provide an extensive table of contents of many agency programs and services. However, many government agencies have begun re-orienting their Web services around the needs of users rather than around their organizational structures.

Further advances in user interfaces are likely to focus both on simplicity and increased power. Digital library technologies, for example, will put the power of multiple databases to more effective uses. Data visualization technologies allow users to manipulate large data sets to get a better understanding of the information they contain. Research into the interaction between people and machines, including speech recognition and 3D modeling, will likely lead to innovations in the way people perceive and use the information environment.

Large systems

The models and processes for designing and developing large, complex systems have advanced much less than the specific technologies they might employ. While all organizations face this issue, the development of large government information systems face special challenges that lead to an especially risk-prone environment. Typically, a significant number of participants and organizations have a stake in the system. This may be due to the innate complexity of the underlying program or existing systems, to legislative mandates, or because a large number of organizations play a role in the system development process. In addition, because of government funding rules, multi-year projects must usually be developed with a series of single-year budgets. Because they are developed with taxpayer dollars in a public setting, these projects are subject to a high level of external criticism and public scrutiny. In such an environment, it is very difficult to maintain consistent approaches to architecture, data definitions, data collection, information quality, data integration, and overall system functionality.

These complications add time, cost, and complexity to the development life cycle. As a consequence, design

and implementation may take years, conflicting directly with the rapidity of technological change. By the time they are completed, the best technologies for the job may well have changed. For example, the recent redesign of the air traffic control system by the Federal Aviation Administration was begun before the widespread commercialization of global positioning systems. Such major technology shifts can cause wholesale changes to system design in the middle of the development process.

Existing software development models such as the waterfall and spiral models do not deal explicitly with these kinds of changes. Prototyping, while very useful in some projects, seems to have less utility in dealing with the complexities of these large systems with their enormous interoperability issues, and long development times.

Human and organizational factors

Most of the research currently conducted to support government's transition to the digital age is focused on technology itself. However, given the complexity of the environment, the need for government applications to work well in a variety of settings, and the interdependence of so many players, technology research alone is insufficient. Other powerful factors, discussed briefly below, shape the ability of government to adopt and deploy IT effectively.

Human factors

The degree to which individuals accept new technologies and the manner in which they learn and adapt to them are all factors to be considered in the deployment of new tools. Recent studies about the success of information systems in organizations suggest that more than 80 percent fail to achieve their objectives or to be implemented at all. The foremost reason for failure is the lack of involvement by system users in design and deployment. Lack of attention to user needs and preferences is a common weakness in the design and deployment of advanced technology.

In government information systems, with their tendency to be used in a wide variety of physical settings by users who may have markedly different levels of interest and skill, this is a particular problem. How can we design technologies or systems that work in both a large urban setting and a small rural one, or in an affluent organization and a shoe-string operation, where the technology tools likely to be available to users are not the same? Beyond questions of design are considerations of user training and support. Too often, new systems are accompanied by one-shot training programs, often out of synch with the actual implementation schedule, that do not provide for ongoing updates or active user support. Universal design principles have been developed to guide us toward systems that are more useable, more in tune with the way people think and act, and more adaptable to the different ways that people work and learn. These principles, such as the ones developed at the TRACE Center at the University of Wisconsin, focus on such topics as accommodation of a wide range of individual preferences and abilities, ease of understanding regardless of a user's experience or knowledge, and tolerance for errors. Any system could be made more usable by incorporating these principles in design. Moreover, as government moves toward more systems that offer self-services to the public, these design principles will increase in importance.

Organizational learning and adaptation

Just as human factors circumscribe the use of new technology, organizational design and behavior also figure prominently in the adoption and use of new technology. In turn, successful adoption of new technology has a significant effect on organizational viability and performance. While Industrial Age organizational forms are well suited to the technologies of efficiency and specialization, Information Age technologies presuppose organizations that thrive on information flow and sharing, asynchronous communication, and analytical thinking.

The organizations of the Industrial Age had structures and cultures which facilitated hierarchical decision making, specialized and narrowly defined jobs, and efficiency in production. In the Information Age, the structure and culture have evolved to create organizations where decisions and communications can occur anywhere in the organization, jobs are fluid, and flexibility and attention to customers are highly valued. Here, technology is viewed as an enabler to meeting the mission and goals of organizations, rather than as a control mechanism. Automation is no longer an alternative process in organizations; it is a basic process. Indeed, IT is now often considered a strategic asset that adds value to the routine transactions and processes of organizations.

What is technically possible may not be organizationally feasible or socially or politically desirable

Successful organizations today are characterized by insistence on knowledge, productivity, and innovation. In order to capture the value of these key variables, organizations must engage in constant change. The new models for change reflect the idea that change is discontinuous, that is, it cannot be controlled or anticipated. These models call for organizations to "think outside the box," to improvise, to unlearn the past, and to stretch beyond their current capabilities. Information technology is a necessary ingredient in this discontinuous change environment. Recent history shows that IT can both drive and enable change. The critical factor in these changes is the ability of organizations to select appropriate technologies, implement and diffuse them, and adapt to new ways of working, even when there is little experience and no clear-cut rules or procedures to guide them.

As organizations experiment with new technologies, they change business processes, communications methods, work flows, decision making, and even the basic structure and boundaries of the organization itself. With technology embedded in organizational functions, geography and time are no longer restrictive, nor are traditional hierarchical and departmental

barriers. By incorporating information technology into an organization's infrastructure, new options of structure, culture, decision making, teamwork, leadership, and communication become available. Inevitably, organizational norms are reshaped.

Emerging organizational forms and new models of collaboration

People sometimes associate a government program or service with a single public agency. Most everyone expects that the local Social Security Office is the place to file for Social Security retirement benefits; if you need to renew your driver's license, you contact the Department of Motor Vehicles. But what if you want a fishing license or need to find a nursing home for your elderly mother? When you drive to work on a snowy day, who plows the roads you travel or operates the bus that takes you from the county you live in to the one where you work? Who really pays your Medicare claims? All of these public services are offered through a complicated set of public-public and public-private linkages. Some are formal and well-defined, others are more dynamic and ad hoc.

Interorganizational networks are emerging in nearly every dimension of work and society. Traditional theories of exchange and resource dependence, based mostly on private sector research, are inadequate to explain either the partnerships and collaborative models or the mixed models of cooperation and regulation that are becoming prevalent in the operation of government programs. These networked forms of organization are emerging in every domain from health care, to social insurance, to infrastructure. Networked information systems are just one feature of their structure and operation. These organizational entities also encompass new forms of communication, decision-making, financing, and accountability.

Consider the National Spatial Data Infrastructure (NSDI) in which Federal, state, local and tribal governments, along with the private sector and academia, are working to develop and promote better access to geospatial data. Geospatial data plays a key role in helping communities synthesize information relevant to complex economic, social and

environmental issues, but these data are often difficult and expensive to locate, obtain, and integrate. The NSDI features a national data clearinghouse and other activities to help organizations and individuals know the characteristics of data, find and access data owned by others, obtain common sets of data to use as building blocks, and transfer and integrate data among users and providers through the use of data models and standards for common classification systems and content.

In the State of Washington, a high speed Information Network for Public Health Officials (INPHO), allows local health professionals to share information about prevention services, emergency notices, training, and health reports, and gives them the ability to act quickly to solve public health problems. A joint project of the Washington State Departments of Health and Information Services, local health jurisdictions, and the Federal Centers for Disease Control and Prevention, INPHO offers access to timely, relevant, accurate and authoritative information to support local decisions and actions. As an example, local officials were recently able to compare DNA samples with others in a national database allowing them to quickly identify and respond to outbreaks of E-Coli.

Policy, management, and technology march to different drummers

Throughout our history, developments in technology have emerged much faster than the evolution of organizational forms. Global communications have eliminated the barriers of time and place, and digital information has broken the bond between information and its physical format. Yet, most agencies and businesses are still organized for the physical limitations of the Industrial Age. They continue to rely on specialization of tasks and command and control management structures. Public policies lag farther still behind technological evolution. Only in the past few years have policy makers begun to tackle the policy implications of global telecommunications and to move beyond the policies developed when information was a matter of printed media and limited broadcasting.

Policy

Management   **Technology**

**Domains of Digital Government**
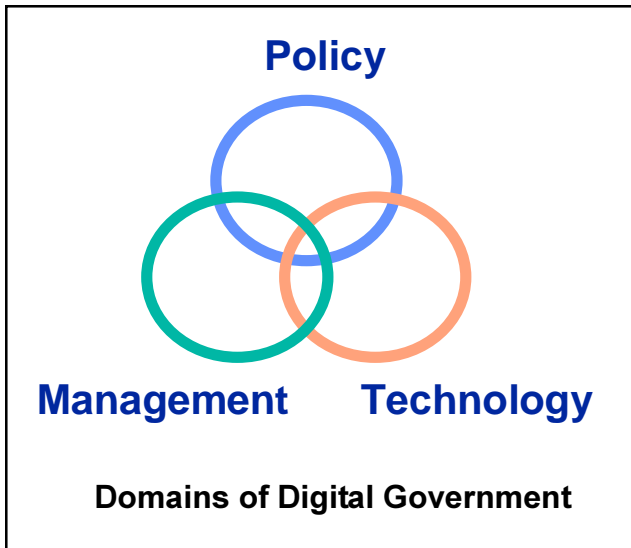
The pace of technology responds to the forces of scientific inquiry and innovation. Organizational change more reflects the ability of humans to recognize and adapt to changes in their environment. This slower process is especially difficult in the public sector as it is bound by civil service systems, one-year budget cycles, and rules and procedures cast in both statute and regulation. Finally, by design, public policies change only when there is a broad consensus that change is needed and will move our nation, community, or society in a desirable direction.

The interaction of these three domains generates a very important societal debate because what is technically possible may not be organizationally feasible or socially or politically desirable. Recent court decisions about the transmission of objectionable material over the Internet are an excellent case in point. The technology has made it possible for anyone, anywhere to post adult-oriented information on the World Wide Web. Much of this material would not be readily accessible by children in most other media, but on the WWW very few limitations can be imposed that protect children but do not also infringe the rights of adults. Elected officials, interest groups, information professionals, states, and courts are all struggling with the issues this generates around free speech, protection of children, the role of the market, the applicability of existing laws, and the meaning of community standards.

Meeting the goals of the Digital Government Program requires research that spans policy, management, and technology domains. Valuable as focused investigations are, they are insufficient if they remain locked in disciplinary niches. We also need interdisciplinary approaches designed to understand the interrelationships among policy, management, and technology factors. To do this will require change in the way research is conceived, funded, and conducted, as well as changes in the way research results are disseminated and used. The following sections discuss the workshop results in terms of specific research needs, broad research challenges, and recommendations for dealing with them.

3. Government needs for the 21st century
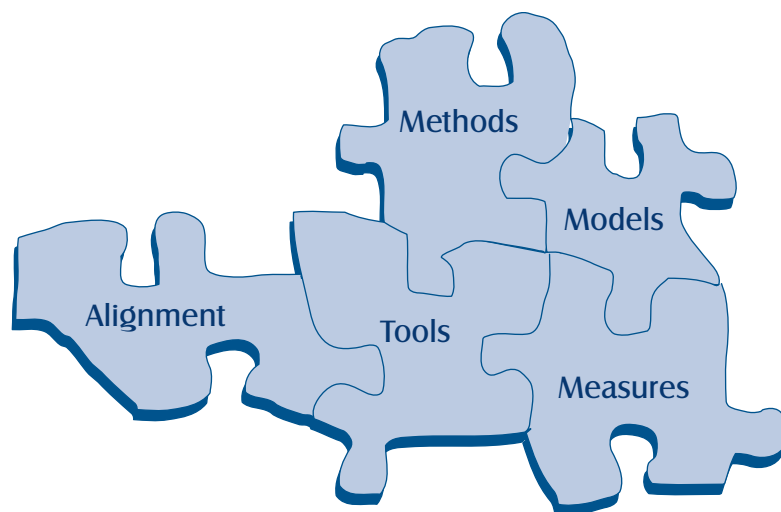
Government managers have critical needs for models and tools to shape, manage, and evaluate 21st century services. These needs present research opportunties for both information and social scientists, and can provide a venue for more active and useful interaction among research disciplines and between researchers and practitioners.

The October 1998 workshop discussions reflected the dimensions of government and the changing technological and organizational landscape. Working in small groups organized by level of government and research discipline, the government participants discussed the challenges they see in the years ahead and researchers debated the strengths and weaknesses of their current approaches. As a result, the participants produced a list of eight critical governmental needs which can be translated directly into research themes. These needs collectively comprise key questions of understanding, development, testing, evaluation, and dissemination of new knowledge about how government might operate in the digital age. The participants also reviewed the historical ways in which research and practice interact and discussed potential changes that would make this relationship more valuable than it is today. The results are discussed below and are illustrated in Table 2 by some of the potential research projects that were generated in a "marketplace of ideas" conducted at the end of the workshop.

Interoperable systems that are trusted and secure

Many information systems that support government services need to be both trusted and interoperable. Interoperable systems are ones in which several systems based in different organizations work smoothly together. Trusted systems have built-in security and authentication features that allow their users to assume a high level of safety and integrity. Such systems must deal effectively with several difficult issues that emanate directly from the complex and dynamic environment of public programs. First, system development methodologies are needed that deal well with the scope and diversity of users, customers, and stakeholders that are involved in government information systems. Second, research is needed to understand the potential for, and the limits of, integration across technological, organizational, and political dimensions. Third, because most government services are expected to be available in consistent form in every community, systems must operate with equal quality on both very large and very small scales.

Key research questions:

- ➢ What institutions, laws, and policies are needed to support interoperable government systems?
- ➢ How should the costs of interoperable systems be distributed among the participating organizations?
- ➢ What is the role of government in the development of standards?
- ➢ What tools and approaches work best for smaller governments and agencies?
- ➢ What are the technical, legal, policy, and management issues surrounding authentication in the public sector?

Models for electronic public service transactions and delivery systems

Currently in the U.S., approximately 90 percent of all government services are still delivered in a face-to-face mode. With the proliferation of the Internet among government agencies and citizens, it is now possible to offer new services, integrated services, and self-service in ways and places never before possible.

The ability to transact business or have an actual say in government in an electronic environment could bring the benefits of disintermediation, a more productive and less costly method of service and information delivery. The public could benefit from information and services that are directly accessible and available all the time, without the intervention of a public employee. Such service models, however, require new methods of authentication, recordkeeping, security, and access. They need to be supported by analyses of cost-effectiveness that take into account more than the costs and effects internal to the government. They need to recognize that not all citizens will be able or willing to interact with government in this new way, and that multiple points and methods of service will be required in many instances.

Key research questions:

> Who benefits from "one-stop" service models and how should those benefits be measured? Similarly, what are the costs and who pays them?
> How can services be made available to those who can't or won't use electronic means?
> What are appropriate risk management methods for making the transition from traditional to electronic services?
> What criteria should determine whether value-added services should be provided by government or by the private sector?

Better methods of IT management

Every government IT manager is looking for ways to design and maintain more successful systems. Efficient design processes, tested and documented methods of project management, software development, and system upgrades and migrations are all needed. Practitioners want ways to build learning into the IT management process and to anticipate and plan for future technological capabilities. They seek leadership models and ways to bring and keep IT on the agenda of top executives and elected leaders. The cost of IT, and its distribution across different players, is a major concern. This issue covers a broad terrain, ranging from the costs of upgrading aging infrastructure for early adopters, to the costs of implementing systems that require participation, but do not cover the costs, of other organizations. Contract management and oversight of outsourced development and operations are becoming critically important, as is the need to deal with the shortage of IT skills in the labor market. IT managers also need ways to assess the applicability of private sector business models to government initiatives and ways to engage private companies in the operation of public service systems.

Key research questions:

> What improvements in design processes will lead to more successful systems?
> What are the common characteristics of successful government IT projects?
> How do and should practitioners identify and adopt "best practices?"
> What methods can government employ to better anticipate changes in the technology environment?
> How should resources be distributed between infrastructure and applications?
> What are the characteristics of effective outsourcing arrangements? What skills, techniques, and knowledge must government contract officers possess?
> What methods of enterprise planning work best in which environment?

Methods and measures of citizen participation

Internet technologies can facilitate a more direct interaction between citizens and government through the development of a digital democracy or electronic commons. The Internet and the World Wide Web make this a viable next step in our democracy. Casting one's vote on the Internet, attending Congressional hearings or City Council meetings via the Web, instant generation of public opinion polls, interactive candidate debates, and easy public access to government data are but a few of the potential outcomes. However, important questions about the effect of digital democracy abound: To what extent, and with what consequences, will this capacity enable greater involvement of citizens in their own governance? Will more or different kinds of citizen participation change the nature and role of political leadership and democratic institutions? Will instant expressions of personal and public opinion improve or degrade the quality of public discourse and formal policy deliberations?

Key research questions:

- ➢ What knowledge and technologies must citizens possess in order to participate in electronic governance?
- ➢ Does the existence of electronic means of communication improve citizen participation in democratic processes?
- ➢ What is the potential for intelligent agents and customized interfaces to change the way citizens participate in government?
- ➢ How must the processes of governance change to account for electronic participation?
- ➢ How does electronic participation affect citizen trust in government?

Models for public-private partnerships and other networked organizational forms

Given the diversity of players involved in delivering government services, the development of effective IT systems may require new coalitions of partners at all levels of government and between government and the private and nonprofit sectors. The complexity of the resulting organizational and technological relationships is daunting. Different public agencies operate under different, sometimes conflicting, authorizing statutes and appropriate funds through separate, but related processes. Federal, state, and local levels carry out different, but overlapping, constitutional purposes. There are considerable legal, economic, and ethical issues associated with private companies engaged in public programs. The technology architecture and infrastructure associated with networks of interdependent, but separate, organizations is not subject to the same planning, support, or financing methods that characterize more traditional organizational forms. Answers to these and other questions related to integration of functions and technologies are critically needed.

Key research questions:

- ➢ What are the conceptual and practical dimensions of "virtual agencies?"
- ➢ What are the characteristics of effective service delivery networks made up of multiple public organizations or mixtures of public and private organizations?
- ➢ How can public agencies leverage private sector innovations to improve services to the public?
- ➢ What are the limitations of private sector involvement in the delivery of public services?

> Government needs

generate
questions for

Intuitive decision support tools for public officials

The advent of technologies and data standards that support and encourage information search, selection, analysis, and sharing may change the nature and effectiveness of executive decision making. Many kinds of public officials make decisions in a variety of settings under a wide array of conditions. Elected officials at the Federal, state, and local levels make policy decisions; appointed and career government professionals decide how to interpret policies in the context of program and agency operations. In some cases the decision process is very structured, in others it is more informal. The kind, amount, and timeliness of information available and the openness of the decision process are also strong influences on the decision-making process. These tools may also have implications for public participation and open government.

Key research questions:

- ➢ What tools are effective in integrating legacy databases to support policy deliberations and management decisions?
- ➢ What are the conditions for successful use of advanced simulation and modelling of social, technical, and physical systems?
- ➢ How do decision makers value these tools compared to other ways of deciding?
- ➢ What kinds of decisions need to be supported by technology and in what ways?
- ➢ What tools are best in situations of information overload? Information insufficiency? Variability in information quality?

Archiving and electronic records management frameworks and tools

With most information now created in electronic rather than physical form, issues such as record definition and content, version control, public access, and ongoing preservation affect the ability of government to function efficiently and maintain history and accountability. Government officials need to provide for long-term preservation and use of records in a technology environment that values and encourages rapid change and innovation. There are issues related to management and preservation of both single- and multi-media records. Questions about principles and methods of access by internal and external users, for both primary and secondary purposes, present a host of policy, management, and technology problems.

Key research questions:

- ➢ What is a public record?
- ➢ What technical infrastructure is needed to maintain a digital archive?
- ➢ How can deteriorating traditional records be cost-effectively transferred to long-lived media?
- ➢ For records worth long term preservation, when would a summary suffice and what would it contain?
- ➢ What tools will support intelligent scheduling, appraisal, and retention of digital records?
- ➢ How can we compare the cost of archiving to the value of the archived record?

generates new
knowledge to meet

Research

Matching research resources to government needs

Applied research is not often rewarded by academic value systems. As a consequence, researchers often pursue theoretical research instead of field work. Government agencies often will not or cannot wait for the results of traditional research to affect their decisions. On the other hand, useful research findings often go unnoticed because the form and outlets in which they are disseminated are unknown or unattractive to practitioners. The most valuable forms of research must involve a variety of activities that lead to ideas that government can use directly. They also demand research relationships that benefit both researchers and practitioners.

Key research questions:

➢ What research-based products are used by, and useful to, government practitioners?
➢ What methodological innovations can speed the production of research results and the dissemination of useful knowledge?
➢ What are the characteristics of successful partnerships between government agencies and academic researchers?
➢ What institutional relationships between higher education and government lead to relevant and timely research for government use?
➢ What methods can researchers employ to better anticipate the future knowledge needs of government?

Table 2. Preliminary Ideas for Digital Government Research Projects

Assess the readiness of communities to engage in electronic citizenship

Assess the integrity and integratability of data from a network of multiple sources to answer overarching questions about the social and economic effects of IT

Case studies of electronic public service models

Clearinghouse of resources for the development of data standards

Co-evolution of local government services and citizen involvement in service design

Comparison of several structured forums for electronic democracy

Coordinated collection, analysis, and integration of community intelligence in government IT development

Cost-benefit model for government archives

Create government-academic research cooperatives responsive to government IT needs

Design a prototype digital agency

Design and prototype selected public utility services to the home / highway

Design functional requirements for archiving Welfare Reform data

Develop and assess alternative scenarios of government IT operations

Develop and test alternative policy regimes for authentication

Develop Web-based tools to manage electronic records

Digital government scenario development, utilization, and evolution

Effectiveness of decision support tools for public officials under varying conditions

Empirical assessment of the diffusion of "best practices" in government IT

Explore the relationships among the design process, resource management, and knowledge management as components of IT management in government

Filters and agents for interacting with the White House online

Identify the characteristics of effective human service delivery networks

Improve courtroom production through use of IT workflow tools

IT and the support of civil society: helping voluntary organizations complement the work of government

National virtual clearinghouse for government research needs

National virtual clearinghouse for IT research relevant to government

Promoting professional learning and knowledge management in government IT

Prototype of a digital archive for national GIS data

Role of XML and competing standards in integration of data systems

Security agents for self healing and aware networks

Self-organizing information networks that provide a single window into the data sources of separate organizations

Tools for mapping the content and contact points of organizational networks

Understanding and developing best practices through analysis of informal contacts among organizations

Web-based information resource to support IT outsourcing by government

Web-based support for volunteer-run after school programs

White paper for legislators re: management of records in the electronic age

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4. Designing a multidisciplinary research enterprise for Digital Government

Researchers need to recognize and address a number of barriers that stem from the tenuous relationships between research and practice and from the disciplinary traditions of research itself. Several models offer ideas for designing a research enterprise that reduces these barriers and forges more mutually beneficial connections among disciplines and between practice and research.

Applied research challenges and opportunities

The needs stated above present many opportunities for applied research, but traditional research models and a historical lack of connection between research and practice are serious obstacles to success.

Divergent objectives limit communication between researchers and practitioners

First, although academic research can have a significant influence on government practices, the government and research communities have very different value systems that need to be taken into account. Government is risk-averse by design, and research by its nature tries to push us beyond what we already know. Government managers often need quick answers, while researchers tend to take a longer-term view. Practitioners want sound, empirically-grounded advice as they make decisions; they have less interest in lessons learned from retrospective analysis or laboratory experimentation. They welcome objective information, but avoid researchers who seem to have a policy agenda of their own. These different ways of thinking about the world are both valuable and need to be linked in new models for informing and integrating practice and research.

Research, like government, is organized into specialties

Like government, research has its own specialty structures that organize education, discourse, information sharing, and funding around specific disciplines. These structures focus on and continually expand the depth and sophistication of knowledge within each discipline. However, they also tend to prevent people in one field from seeing the issues in another – even when they are common to both. To meet the needs outlined earlier, the research community must find ways to combine perspectives and disciplines to achieve not only advances in each field, but synergy across them. Many of the issues and opportunities of government in the digital age combine a need for invention, implementation, and evaluation, and this implies a need for the social and information sciences to work together. Studies of program and organizational design, implementation, and performance (the traditional province of social scientists) are needed as much as those aimed at technological design, development, and deployment.

Research that views government holistically is highly desirable, but complex and expensive

Both traditional forms of federalism and the new demands of devolution exemplify the extraordinary interdependence among public agencies in the conduct of government programs. Similarly, the nonprofit and private sectors are increasingly important actors in the

delivery of government services. These intricate interdependencies require a holistic approach to research that accounts for the interactions among levels of government and between the public and private sectors. The integration of complex information systems into even more complex organizational and policy environments is a very poorly understood process that is fraught with risk and prone to failure. The integrative models and rich explanations that would help make these endeavors more successful demand long-term, multi-site studies of real organizations. Sustained access to venues for this kind of research requires trusting, long-term relationships between researchers and government managers, as well as substantial multi-year funding.

Digital Government is inherently multidisciplinary

Finally, the concept of a Digital Government lies at the intersection of three domains of knowledge: public policy, organizational behavior and management, and information technology. Throughout our history, developments in technology have emerged much faster than the evolution of organizational forms and policy guidelines. Despite their different cadences, these three domains constantly interact with one another, generating many questions and conflicts about what is technically possible, organizationally feasible, and socially desirable. Research that focuses on the intersection of policy, management, and technology is inherently multidisciplinary, complex, and difficult to design and manage, but essential to achieving the goals of Digital Government.

Existing research models

Past long-range research investments and several existing applied research programs offer models for a robust program of applied Digital Government research.

From about 1975-1990, NSF and private funders supported the Urban Research in Information Systems program (URBIS) at the University of California at Irvine. URBIS looked at IT use in a wide array of municipal government functions, from law enforcement to public works to general fiscal

administration, through two major waves of data collection across a whole level of government. Its findings and conclusions constitute a significant portion of our knowledge about the effects of IT on government. One of the largest and longest-running studies of computerization in any sector, URBIS illustrates that studies of this magnitude are both worthwhile and feasible.

Today, the Center for Technology in Government (CTG) at the University at Albany/SUNY conducts applied research projects with New York state and local agencies. The Center leads teams of agency staff, corporate partners, and university faculty in a process of problem definition, stakeholder analysis, prototype development, and cost-performance evaluation. The results help agencies decide whether and how to pursue their IT projects. The same results are generalized to the extent possible and widely disseminated to practitioners in handbooks, presentations, and Web-based tools. Scholarly articles present new knowledge or extend existing models in the literature of public management and information science.

In Quebec, Canada, a not-for-profit organization created by the Provincial Government conducts a similar program of applied research projects. Le Centre Francophone d'Informatisation des Organisations (CEFRIO) is funded by a combination of government support and corporate membership fees. The projects, which focus on both public and private sector concerns, are commissioned by the CEFRIO board of directors and conducted by universities throughout Quebec. Practitioner-oriented results include handbooks, diagnostic tools, and education programs offered by CEFRIO. The university researchers incorporate results into their ongoing research and scholarly publications.

The Program on Strategic Computing and Telecommunications in the Public Sector at Harvard University's John F. Kennedy School of Government conducts leadership workshops and action research involving emerging and existing government programs that focus on such topics as IT innovation in government, performance measurement, and the role of political leadership. The program produces case studies for executive and university education, as well as reports and scholarly articles.

5. Digital Government Program recommendations

Complexities of the public sector environment, needs identified by practitioners, and research opportunities and challenges that emerged from the workshop discussions led to six recommendations to the National Science Foundation for furthering the goals of the Digital Government Program.

1. Support research at the Federal, state, and local levels as well as investigations into intergovernmental and public-private interaction.

The innovations and experiments that abound at the local, state, and national levels provide countless opportunities for grounded research. As the Ford Foundation Innovations in American Government Program shows, ideas that emerge in every corner of the nation have the potential to mature into advanced applications that can be adopted in many other places, and even become nationwide service models. The Digital Government Program should therefore emphasize the multi-faceted nature of American government and encourage projects at each level of government. It should also support studies of multi-level functions and programs that link the public, private, and nonprofit sectors. A multi-level, cross-sectoral research program would have significant benefits:

- Better appreciation for the singular capabilities, needs, and issues present at each level of government.
- Increased understanding of how the interconnectedness of government agencies affects the administration, performance, and cost of public programs and the deployment and performance of information systems that support them.

- Better understanding of the role of the voluntary not-for-profit sector in the delivery of government services.
- New models for managing private sector involvement in government operations and better understanding of the applications and limits of private sector business models for public sector functions.
- Improved models of the process of innovation as well as better understanding of the diffusion of innovation in the public sector.

2. Attend to issues of "governance" as well as "government" in the digital age.

Information technology can play a significant role in transforming not only government services and administration, but also the working of democratic institutions. Projects that focus on the nature and effects of "digital governance," the roles and rights of citizens, and the functioning of civil society should be included in the Digital Government research program. In doing so, the program will:

- Encourage both analysis and reflection about the effects of emerging technologies on citizens and non-governmental institutions.
- Account for the role, capabilities, and preferences of citizens in decisions about how to use technology in the service of democracy.
- Understand how the infusion of technology at different points in the democratic process affects the distribution and exercise of power.

3. Encourage methods that describe, account for, and evaluate questions of service and system integration and environmental complexity.

In order to be successful, the research program will need to address the interplay among technical, management, policy, and organizational factors influencing the information systems that support government operations. With this diverse set of research questions and objectives, the program should encourage research in both social and information sciences and welcome a variety of research methods, particularly ones that directly involve system users and beneficiaries. These might include:

- ➢ single and comparative case studies
- ➢ experimental testbeds
- ➢ single and multi-site field research
- ➢ surveys
- ➢ longitudinal studies
- ➢ network analyses
- ➢ evaluation studies

4. Seek innovative funding models that build a larger resource base for Digital Government initiatives.

At present, the NSF funds allocated to the Digital Government Program are quite modest and are insufficient to support sustained research into the complex questions posed at the workshop. NSF should consider innovative funding models to increase the amount of resources available to support the program. The following mechanisms should be explored:

- ➢ Encourage cash or in-kind matching by grantee institutions. This option should not become a barrier to participation by smaller institutions or jurisdictions. In-kind matches could include such items as access to internal data, sponsorship of advisory committees, dissemination of project results, and similar activities that further the purposes of the research.
- ➢ Use Digital Government grants to add a formal research component to applications projects that are or will be sponsored by government agencies. In this way, Digital Government grants will

encourage formal evaluation and documentation of empirical results, leading eventually to more formal models of organizational and system performance.
- ➢ Engage other federal research agencies and private foundations in jointly funded research. The questions likely to be posed by Digital Government research projects are of deep interest to a variety of funding organizations. NSF should pilot test a few grants that combine funding from several sources to determine the feasibility and effectiveness of a mixed funding model.
- ➢ Explore partnerships and incentives for the private sector to participate in the program through use of private research and development assets, and by including private sector strategic requirements for Digital Government services in the program design.

5. Link research and practice in an ongoing exchange of knowledge, needs, and experiences.

Given the wide communications gap between the academic and government practitioner communities, and the significant opportunity for improved practices through collaboration, new methods are needed for disseminating research results to practitioners and for infusing research with the problems of practice. NSF should encourage the development of organizational structures, information sharing mechanisms, and funding methods to bridge the gap between these two cultures. Specific recommendations include:

- ➢ Sponsor workshops on topics of importance to both practitioners and researchers to provide opportunities for members of both communities to express their needs, explain their capabilities, and explore mutually beneficial activities.
- ➢ Require researchers funded under the Digital Government Program to prepare reports specifically for a practitioner audience periodically throughout the grant period.
- ➢ Sponsor one or more Web sites that support practitioners' use of research skills and results and researchers' quest for field tests and other practical venues for their investigations.

6. Create a practitioner advisory group for the program and include practitioners in the review panels.

If the Digital Government Program is to succeed in integrating research and practice, practitioners must have a major role in setting priorities and selecting projects to be funded. An advisory group made up of practitioners from all three levels of government would assist in program design, in attracting government funding and research partners, and in disseminating results. Practitioners must also participate in reviewing proposals that seek to study their areas of expertise, whether they be specific policy areas (such as public health or transportation) or functional domains (such as service delivery or regulatory affairs). This will also help insure the relevance of projects, access to venues for field research, and an audience for the research results.

Conclusion

To build a digital government for the next century, the nation needs to assemble and employ an array of talents and resources. Evolving technologies will surely continue to be a catalyst and agent of change, generating increasing need for technological research and development. The change that technology brings with it demands equally serious research investments into questions of political, institutional, and organizational response and adaptation. To meet these challenges, NSF's Digital Government research program must foster multidisciplinary, multi-method research. This research program must extend across time and physical and political geography, and be linked in mutually beneficial ways to the goals and the practice of government.

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Appendix A. Workshop summary

Designing the Digital Government of the 21st Century: A Multidisciplinary Workshop

The National Science Foundation's program on Digital Government supports experimentation and research to improve the information-based services that government provides to citizens or uses internally to carry out its mission. On October 5-6, 1998, 67 researchers and government practitioners convened in a workshop funded by this NSF program to discuss ways that government practitioners and academic researchers can collaborate to produce innovative and effective information-based government services. Held in Arlington, VA, and led by the Center for Technology in Government at the University at Albany/SUNY, the workshop was designed to identify and develop research themes and projects that can further these goals.

This workshop was one in a series funded by NSF to promote interaction between researchers and government practitioners. The October 1998 workshop focused particularly on the environment in which government information services are developed. It recognized that government programs and service delivery mechanisms are developed in a complex multi-layered Federal-state-local system in which many organizations play significant and different roles. It also emphasized that development efforts must deal with interactions among the political, organizational, technological, cultural, and human factors that shape the implementation environment.

The workshop had several goals:

➢ Propose criteria for investing in research activities that will have the greatest positive impact on government programs, services, and customers.
➢ Identify issues, opportunities, and themes for cross-disciplinary research to foster the creation, adoption, and diffusion of innovative and effective government IT applications.
➢ Recommend ways to build mutually beneficial links between researchers and the information services and government management communities.

➢ Develop ideas for specific research projects that would contribute to more effective use of advanced technologies in government.
➢ Recommend criteria for evaluating the effectiveness of the research program.

To help focus attention on research that would have practical implications, the workshop participants were asked to take a "program-centric" view of the information content and processing needs of government operation. By paying special attention to the needs of government program managers, workshop presentations and discussions were designed to lead to research ideas that have the potential to be of pragmatic use in government.

Preparation

Two activities helped set the stage for the workshop. During the summer, the organizing committee issued a call for papers addressing the themes of the workshop. A variety of academic researchers, private consultants, and government practitioners responded; from the submissions, 18 papers from a variety of perspectives were selected to serve as a backdrop for the workshop. These were made available on the workshop Web site for the participants to examine before the workshop. Several authors were invited to attend or make presentations at the workshop. In a second activity, the workshop organizers conducted a review of award-winning government applications to identify exemplary uses of IT in government that could serve to underscore the "program-centric" theme of the workshop. From this group of several dozen programs, a total of six were selected for presentation at the workshop. These served as examples of the range and depth of uses of IT at all three levels of government.

The workshop organizing committee then invited additional participants to represent a broad mixture of stakeholders: government officials and managers from Federal, state, and local levels; researchers from a variety of fields including social, information, computer, and computational science; and representatives from the private sector, nonprofit

organizations, and the international government IT community. Altogether, a total of 67 people participated in the workshop.

Presentations

The workshop began with small group discussions designed to elicit participants' impressions of government information systems as citizens, public managers, and researchers. Some common themes emerged from this discussion, including a desire to take advantage of technologies that provide one-stop-shopping, the lack of funding for government IT initiatives, resistance to cultural, organizational, and technical change among government organizations, and the general risk-averse nature of government. These discussions also pointed out the extensive involvement of non-governmental organizations in the delivery of public services and the difficulty of designing and delivering services that are of uniform quality in the face of a wide variety of local conditions.

Following this discussion, the workshop continued with presentations of government applications and academic research capabilities. The six government applications that were highlighted represented all levels of government, addressed a variety of government policy and management objectives, and had different levels of scope and complexity. Some of these programs use IT to help achieve single program objectives: the IRS e-file program, a Texas initiative to detect fraud and abuse in the Medicaid program, and a computerized statistical and monitoring program of the New York City Police Department. A second set of presentations focused on programs that cross the boundaries of organizations or levels of government: the Federal Geographic Data Committee and its National Spatial Data Infrastructure initiative, the Washington State Public Health Network, and the public community network of Santa Monica, CA. The research presentations covered the state-of-the art in four relevant areas: overarching issues of information and society, applied research commissioned by government agencies, trends in computer and information science research (including a summary of the initial workshop funded by the Digital Government initiative in May 1997), and trends in social science research that pertain to government use of IT.

Workshop participants also heard from Thomas Kalil, Director of Science and Technology for the National Economic Council, on Administration goals and initiatives relevant to the Digital Government Program. NSF Digital Government Program Officer Larry Brandt reviewed the goals of the program and outlined the nature of the proposals received in response to the first round of project solicitation in September 1998.

Discussions

The participants divided into five homogeneous groups to brainstorm about approaches to linking government practice and academic research. The three government groups (comprising Federal, state, and local practitioners, respectively) were asked to identify government's current and future administrative and service delivery needs that advanced IT can help meet. The two research groups (in information technology and social sciences) were asked to identify research topics and approaches that can contribute to more effective use of advanced technologies in government. From these discussions, eight key needs and opportunities emerged:

> ➢ Interoperable systems that are trusted and secure.
> ➢ Citizen participation in democratic processes.
> ➢ Electronic public service models and transactions.
> ➢ New models for public-private partnerships and other networked organizational forms.
> ➢ Intuitive decision support tools for public officials.
> ➢ Better methods of IT management.
> ➢ Archiving and electronic records management.
> ➢ Matching research resources to government needs.

In subsequent discussions among the participants, a number of issues emerged that need to be addressed to make research collaborations more effective.

> ➢ Although academic research can have a significant influence on government practices, the government and research communities have very different value systems that need to be taken into account. Government is risk-averse by design, and research is quite the opposite. These competing values need to be addressed through the development of new models for informing and integrating practice and research.

➢ With the devolution of government services and increased demand for measurable performance at every level, all levels of government need to be accounted for in the research program. Since citizens and businesses most often interact with government at the state and local levels, the needs for intergovernmental support and research are significant. Similarly, the not-for-profit and private sectors are important actors in the delivery of government services and need to be represented in the research topics explored under Digital Government.

➢ In order to be successful, the research program will need to address the technical, management, policy, and organizational factors that go into successful systems. With this diverse set of research questions and objectives, the research effort should include a variety of research methods, including case studies and experimental testbeds.

➢ Given the wide gap between the academic and government practitioner communities, and the significant opportunity for improved practices through collaboration, new methods are needed for disseminating research into practice and for infusing research with the problems of practice. NSF should consider the development of organizational structures and funding methods to bridge the gap between these two cultures.

➢ Information technology can play a significant role in transforming not only government services and administration, but also the working of democratic institutions. Projects that focus on the nature and effects of "digital governance" should be included in the Digital Government research program.

Specific research ideas

As part of the workshop activities, participants were asked to develop specific research projects that would help address the needs identified in their discussions. A total of 35 ideas were developed by groups of researchers and practitioners working together. The topics ranged from investigations on the forms of electronic democracy, to the role of XML in the integration of data standards, to the management of public records in the electronic age, to the creation of networked virtual organizations for the delivery of public services. We expect at least some of these preliminary ideas will be among those submitted to the Digital Government Program in future rounds of funding.

Additional material pertaining to the workshop, including the agenda, presentations and papers, is available on the workshop Web site at http://www.ctg.albany.edu/research/workshop/digitalgov.html

Appendix B. Workshop participants

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Maria Zemankova, National Science Foundation

Appendix C. Background papers

In preparation for the workshop activities, we issued a Call for Papers to researchers and government practitioners for background papers addressing the themes of the workshop. The organizing committee selected the following papers to provide a backdrop for the workshop activities. All papers are available on the Workshop Web Site at http://www.ctg.albany.edu/research/workshop/background.html

G. Scott Aikens, "Nexus: The Policy and Ideas Network: A Case Study" [gsa1001@cus.cam.ac.uk]

Janet Cichelli, "Designing Government Systems for Day-One Job Performance" [bwhite@wpiusa.com]

Ernie Dornfeld, "City of Seattle Legislative and Historical Information on the Internet: A Case Study for Citizen Access" [ernie.dornfeld@ci.seattle.wa.us]

Brian Ellis, "Securing State and Local Government Web Sites Using Digital Certification Authority and Repository Services" [brian.elis@digsigtrust.com]

Michael B. Fraser and John Boyer, "Electronic Permits for Government in the 21st Century" [michael.fraser@noaa.gov]

J. Gangolly, S.S. Ravi, D.J. Rosenkrantz, and G. Tayi, "Temporal Reconstruction of Authoritative Text in Legal, Accounting, and Regulatory Domains" [ravi@cs.albany.edu]

Alice Hart, "Government and Technology: A Case History of the Pitfalls of Working with Enterprise Community Based Organizations" [ahart@flint.umich.edu]

Mark Hedges, "Anonymity in Internet Voting" [hedges@infonex.com]

Richard Heeks, "Successful Approaches to Information Age Reform" [richard.heeks@man.ac.uk]

Richard Heeks, "Reinventing Government in the Information Age: Explaining Success and Failure" [richard.heeks@man.ac.uk]

Helene Heller, "Delivering Services Online: How to Manage Culture Change in Government Use of the Web" [hheller@incredibyte.net]

Ajit Kambil and Mark Ginsburg, "Public Access Web Information Systems: Lessons from the Internet EDGAR project" [akambil@stern.nyu.edu]

David Landsbergen and George Wolken, "Eliminating Legal and Policy Barriers to Interoperable Government Systems: Phase I: Policy Barriers" [landsbergen.1@osu.edu]

Rick Moore, "Information Needs Assessment Project" [emoore@dhr.state.nc.us]

John O'Looney, "Identifying Opportunities for Effective Cross-Agency Electronic Services Delivery: Spanning the Gap Between Consumers' Needs and the Real Prospects for System Integration and Success" [looney@igs.cviog.uga.edu]

Priscilla Regan, "Privacy and Intelligent Transportation Systems: Results of a National Public Opinion Study and Insights from Investigations of Pilot Projects" [pregan@wpgate.gmu.edu]

Gary Stoneburner, "Common Barriers to IT Security" [gary.stoneburner@nist.gov]

Eswaran Subrahmanian and James Garrett, "Two Experiences in Digital Government" [sub+@cs.cmu.edu]